Centurus tricolor, *Gmel.* (Woodpecker, Spotted.) s.

"Native, and the most domestic of its tribe; I have lately shot them tapping at the facings around the corners of this dwelling-house. Feed like all the tribe upon insects; but this species is particularly noted for destruction to the Indian corn when in a soft and milky state, and may then often be found with the celebrated corn thief the Tanager (*Tachyphonus leucopterus*). In making this accusation against this species, I am inclined to think that while tearing the ears of corn and exposing them to the rain, &c., it is more with a view to secure ants than to destroy corn, as a great many ants are in general collected around the ears once exposed in that soft state. They have two different notes, the regular response being a prolonged whistle, sharp, strong and piercing, at first slow, about sixteen times repeated, quick towards the middle and again prolonged towards the conclusion."

[To be continued.]

XXXII.—*On the different Beds of the White Chalk, and on the Faults and Dislocations which they exhibit.* By J. Toulmin Smith, Esq.

It is certainly no less true of geology than of any other branch of natural science, that it is endangered as much by "false facts as false theories." Such "false facts" are not merely neutrally mischievous: they are fertile sources of positive error and erroneous induction. Even if the true character of the "false fact" is perceived, it will often not be till it has added much to that labour which every true naturalist must oftentimes undergo of "laboriously groping about in the dense labyrinth of facts*."

I called attention some months ago to an important instance of such a "false fact" very authoritatively put forth as to the existence in one geological æra of one of the most extraordinary creatures which geological research has yielded—the Pterodactyle†. It is important to my present purpose to repeat this instance, as it originated in a very common source of such false facts, and one against which the most able inquirer has no defence if he depend for his material on the dealer instead of obtaining it as the reward of the personal exploration in the field of himself or of a confidential collaborator. Many other instances might be cited of positive error which has in this way been promulgated, or in which the danger of promulgating still greater and more sweep-

* Oken's preface to the Ray Society's ed. of his 'Elements of Physiophilosophy.'

† See vol. xix. of this Journal, p. 295, *note*.

ing error has been only averted by the acuteness of a practised and able palæontologist. In immediate connexion with the chalk beds I will name one other instance which is at the present time drawing forth frequent expressions of interest and surprise from geologists,—I mean the alleged discovery of a bed of Ammonites and allied forms in the upper part of the chalk;—a discovery which, without expressing a positive opinion as to the absolute fact implied in it, I can safely say is at present unsustained by any facts in my own collection (in which is a large series of the specimens) or in any other which I have seen, and I shall presently show why the allegation (which implies an induction) has, at present, no necessary basis of absolute fact, even admitting the alleged localities to be correctly stated.

That the interest and importance of geology as a science, in all its branches and applications, mainly depend upon that stratigraphical exactness on which I have before insisted*, must be admitted equally by the palæontologist, the engineer and the surveyor. I propose therefore, very briefly, to call attention now to some points:—I. As to the different and differing beds of the white chalk, by which I mean, that which lies above the chalk marl: and II. As to the causes of the frequent confusion which exists in the determination of the true position of chalk fossils;—which will lead us directly to another interesting question, namely the faults and dislocations which have taken place in the chalk itself, and the time or times at which these have taken place.

I. There is so much external resemblance between hand specimens of the chalk from any of the beds above included, that it is little surprising if those not familiar with actual sections generalize the whole together.

Dr. Mantell divides the beds of which I am speaking into "upper or flinty chalk" and "lower chalk." This division, which was made in his 'South Downs' (pp. 79 & 139), is retained in his 'Medals of Creation' (p. 33). The same division is made by Mr. Lyell (under different names) in his 'Elements,' vol. i. p. 386 (ed. 1841), and, though with even less distinctness, in vol. ii. p. 180. Mr. Morris, in his 'Catalogue' (p. ix), makes a similar division, and in Mr. Tennant's 'Stratigraphical List' just published by the "Society for Promoting Christian Knowledge" a like division is made (p. 37).

In all these cases the presence or absence of flints is made the ground of division of the beds. I do not deny that in one part of the white chalk flints are common, in another part absent or rare. But I altogether demur to this being assumed as any basis for a natural division, believing that presence or absence to be,

* In *loc. cit.*

in the proper sense of the word, a mere accident, in no way *necessarily* indicative of any change in geological deposit, and one which might happen, and in fact has happened, during the course of very different formations, and, as indeed the flinty chalk itself proves, at varying periods during the course of any one deposit*.

We may however find other characters, sufficiently well-marked, which lead to positive and well-defined divisions of the white chalk. Passing over minor subdivisions, three great divisions force themselves upon the observer's attention where the chalk is fully developed, as in the hills and valleys of Kent. These divisions may be stated as—1. the *upper chalk,* which happens to coincide pretty exactly [though by no necessity, as above indicated] with the chalk having horizontal layers of flint, and may therefore be readily distinguished at a glance; 2. the middle chalk, a chalk as white as the upper chalk and lying immediately beneath it; and 3. the lower chalk, which, when wet, has a slightly grayer tinge, though, when dry, not thus distinguishable from either of the above. It is not unimportant to notice, that the distinction drawn by Mr. Lyell (p. 386) between *soft* white chalk and *hard* white chalk is a distinction which will not hold. The upper, middle, and lower chalk is, quite indifferently, hard or soft in different places. There are places in which the middle chalk is so extremely rotten that it is almost impossible to extract any fossil entire. This very chalk, again, by long exposure to the atmosphere, becomes so extremely hard that it will turn the edge of any tool, and is, from its extreme hardness, as impracticable as before from its rottenness.

These three beds are to be distinguished by their organic contents. It is not my present purpose to enter in detail into these; it is sufficient to call attention to the divisions by a few broad instances. The most unpractised eye will at once perceive the difference in the groups of *Terebratulæ* found in the three several beds. The distinctions, not merely modifications, but in marked characters, between the *Echinites* is very great; while the *Inocerami* offer the means of no less broad comparison. These last abound, in extraordinary number and variety, in the middle chalk. The abundance and character of the remains of the vertebrate animals afford no less important means of marking these divisions. I am however for the present content to rest the distinction between the three beds upon the differences presented

* Mr. Lyell states (as above, p. 386) these layers to be "from two to four feet distant from each other." It will, however, be found, in fact, that the differences are much more striking. I am acquainted with localities in which several successive beds are found varying from one to two feet apart, or less,—underlying which is a mass of chalk, without any layers of flints, at least fifteen or twenty feet thick, but below which last other regular layers of flints are found. See vol. xix. of this Journal, p. 15, *note*.

by the *Ventriculidæ* found respectively in each, and which—as I shall particularly show when detailing the species of that family,—belong, in the three beds, to three distinct and strongly-marked groups, a fact which illustrates the importance of the careful investigation of any single family, to whatever class it may belong. Of the three groups into which I shall show that that family must be divided, the first (*Ventriculites*) is found in the upper chalk; extremely rarely any species of it, and then very doubtfully, in the middle chalk: the second (*Kephalites*) is very rarely, and then also doubtfully, found in the upper chalk: I have never seen a single specimen of either from the lower chalk. Of the third group (*Brachiolites*), while some species are perhaps found in the upper chalk and the same are found in the middle, some of the most marked species—differing, with one exception, and even in that with a modification of character, from those last named—are found in the lower chalk and even greensand.

I have remarked that some species of *Ventriculidæ* are found *doubtfully* in one or the other bed. This leads me to notice,

II. The causes of the doubt and confusion which exist as to the true position of many fossils from the chalk, and consequently as to the character of the respective geological æras.

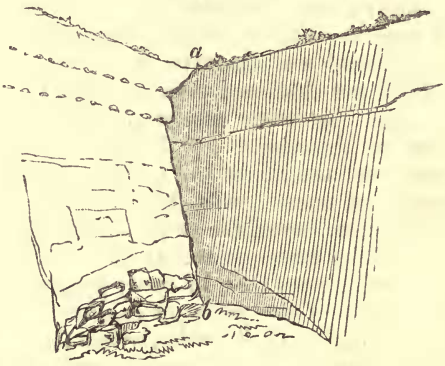
From the particular mode in which the denudation of the chalk has taken place, it happens that, in many pits, in many parts of Kent, the upper part of the same pit exhibits the upper chalk, the lower part the middle chalk, while, within five minutes' walk, lies the deep lower chalk. Now whether fossils be picked up on the floor of such a pit or out of blasted blocks, it will, generally, be equally impossible, from the mere hand specimen, to determine to which bed it belonged. It is in such pits as these that the problematical Ammonites, &c. have been found; and it is in such pits as these that I have picked up the specimens of Ventriculidæ which I have above assigned as doubtful. It is only by very careful and personal examination of individual sites, and not merely of localities, that the exact and accurate determination can be made.

Another important source of error is the faults and dislocations which have taken place in the chalk*. These, in rocks so similar as the different beds of the white chalk, escape any but the closest attention. The following instance is instructive. In the course of the last spring I visited, in company with Mr. Morris, the collection of Mr. Harris at Charing. I learned that there had long been a friendly dispute between Mr. Harris

* I do not allude to such faults as Mr. Lyell figures, p. 27. vol. ii. of the 'Elements,' and which can never mislead, but to cases where white chalk only is seen on both sides, with nothing to distinguish the two to the superficial observer.

and Mr. Morris (whose stratigraphical skill is probably unrivaled) as to whether the pits whence the collection was mainly derived were upper or lower chalk, and my own impression was asked. I unhesitatingly pointed out a large number as from the upper chalk, but presently came to some which I was equally clear were from a lower bed *. I was somewhat startled by the information that both groups were from the *same pit*. A personal inspection could alone be satisfactory. On reaching the pit I found,—and it was fully admitted by both gentlemen,—that it exhibited, exactly in its centre, a clear line of fault, of which the following outline, from a sketch made on the spot, may give some

Fig. 1.

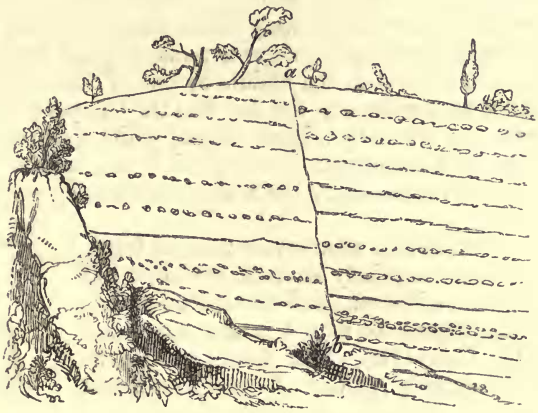


idea. I immediately pointed out to Mr. Harris that all his fossils of the one group came from the upper part of the chalk on the left hand of the line *a*—*b*; all those of the other group from the chalk on the right hand of that line. As far as could be ascertained from his personal knowledge and from exact inquiry among the workmen, this was found to be the case, and he has since informed me that the suggestion thus made has been of material assistance to him in his subsequent observations. The fact was, that the former side exhibited the upper chalk, the latter much lower beds. Here had been a great fault, so great that these so different beds lay side by side with one another. The whole exposed and unbroken surface of the right-hand side, shaded in the accompanying sketch, was polished and glistening, —as true a case of *slickensides* as could be found. The attrition had been with such force that several large flints were found actually crushed in the exact line of fault. The band on the upper part of that side is a thin layer of marl to which I cannot now further allude. The rows of flints on the other side are seen in the sketch.

* I am not, at this time, quite certain whether these were strictly *lower chalk* or *middle chalk* forms, and it is immaterial to the present point.

It is unimportant to the present question whether this is a case of fault in the ordinary sense, originating in upheaval or depression due to causes acting from below, or whether it is a case of sliding towards the valley. In either case it is equally important that it and all such cases should be noted and known; though I have little doubt that it is a true fault. I have since met with another case of undoubted true fault—the direction of the fault being transverse to the valley—at a distance of about twenty miles from the last. Of this also an outline is here given, in which *a*—*b* will be seen to be the line of fault. Both sides exhibit the upper chalk only, but the fault is well seen owing to the displacement of the layers of flint*.

Fig. 2.



Another phænomenon, which is found especially in the middle chalk, is well-worthy of being here noted,—a phænomenon not of fault, but of *dislocation*. In pits which externally appear smooth and unbroken, and lying underneath thick beds which are wholly undisturbed, the chalk will sometimes be found not to lie in unbroken or merely jointed strata, but to be made up of huge masses, each many tons in weight, and each of the faces of every one of which is smooth and polished†. There is no rubbish: all is massive: but there has clearly been very much dislocation and disturbance, and which must have taken place before the beds lying above were solidified.

But beyond each of these evidences of motive force in the beds of the white chalk another is sometimes found, which also is

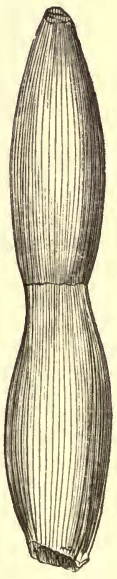
* Many other instances of faults in the chalk have come under my notice, to which I shall probably take a future opportunity of alluding more in detail.

† Something of this kind must explain the case cited by Dr. Mantell, 'South Downs,' p. 149, but the "brown" colour is not present in the instances I have before me.

most frequently exhibited in the middle chalk, and may often mislead or puzzle the observer. In this case the dislocation may best be explained by describing the chalk as *knotty*. One of the huge masses before named, when broken up, occasionally (by no means always) presents a very remarkable appearance. It is full of extremely hard lumps which separate readily from each other and which seem as if made up of bundles of threads,—a character which is often more than merely superficial. It will be clear that, as the dislocation last-named could not take place without some of the masses being violently compressed and distorted, when that compression and distortion took place, the component parts of the mass, according to the tenacity or cohesion of its various organic contents and the varying degrees of its partial consolidation, would necessarily assume the characters which are thus exhibited. I have collected many interesting illustrations of these phænomena,—having found many organic remains quite perfect as to condition, but divided in the middle by one of these knots. In one instance an unfortunate fish has had the fore part of his head driven from its place by a knot, which, while pushing it three inches forward horizontally, has pushed it two inches vertically down. The striæ caused by the friction are usually very clear in such cases.

Sometimes the knots assume very peculiar forms. Specimens, very regularly striated, are often sold by dealers as fossil wood, and the specimen here figured might easily be placed in that convenient group—the Coprolites. The knots in this instance are unusually regular. Several were found, one above the other, like the joints of a stem. I brought away the two figured.

Fig. 3.



Two-thirds nat. size.

As to the time at which these forces acted upon the chalk, it would seem that they have not been confined to any one age. As far as my observations extend, the *dislocations* above-noticed have been temporary and are principally confined to one bed and æra,—the middle chalk. The *faults*, on the contrary, have been more extensive through the beds. The former therefore took place before the close of the secondary period and before the superposition of the upper chalk. The latter must have taken place at a much later period*, and we are not altogether without evidence that it was comparatively recent. Some time ago I obtained, from the solid chalk, the well-preserved tooth of a fossil horse. Without entering into any nice question as to whether this belongs to the species

* It is unnecessary to allude now to the cases of shivered flints in beds,

distinguished by Professor Owen as characteristic of the Miocene or of the Drift*, it is sufficient that his eye at once recognized it as a fossil form. I was careful to ascertain the exact details of the spot wherein it was imbedded. The pit was near the top of one of the highest hills in Kent, on or near which was no diluvium whatever, and a vegetable soil of hardly appreciable thickness. There was no fissure, nor would any disturbance of the bed have been noticed without very close inspection. That inspection however showed that there had been some displacement, which, though the two walls were then so close that the blade of a knife could not be inserted, had doubtless once yawned, and thus enabled this mammalian fossil of the tertiary beds to lodge deep down in what it might be hard to persuade many was not solid undisturbed chalk. It was middle chalk on each side of the line, so that the amount of relative displacement could not be ascertained. The tooth was found about twenty feet from the present surface.

I have thus endeavoured to call the attention of observers to some of the conditions which should be borne in mind by those who, in investigating the chalk formation, geologically or palæontologically, would avoid the danger of making the "labyrinth" of their fellow-labourers more "dense" by the accumulation of "false facts."

XXXIII.—*Description of* Clinteria Hoffmeisteri, *a new species of the family* Cetoniadæ, *from North India.* By Adam White, F.L.S., Assistant Zool. Dep. British Museum.

Cetonia (Clinteria) Hoffmeisteri.

C. viridescenti-fusca supra obscura, subtus nitida; pilosa; thorace albo-marginato, lineaque media alba; scutello albo; elytris albo-marginatis margine interna linea alba, ramulos 2 aut 3 emittente, vitta submarginali rubra, et linea subinterrupta subobliqua mediana; margine suturæ postica vitta alba interrupta; pygidio albo, brunneo marginato.

Hab. in India. Mus. Brit. et "E. India House." *Dr. Horsfield.*

Head cupreous; antennæ reddish; legs and the under parts of a dark purplish coppery red, without spots, clothed with longish ochrey gray hairs; the hairs similar in colour on the upper

as, though they are shivered, the strata have not been dislocated and do not therefore affect the present point. They are of course evidence of some powerful agitation, which was probably the same which, in other spots, produced these faults.

* Brit. Foss. Mammals, pp. 383, 392.